

Applicants respectfully request entry of this response, as the response places the application in clear condition for allowance, or alternatively at least places the claims in better form for appeal. Upon entry of this amendment, Claims 1-9 and 14-20 are currently pending in the application; Claims 1, 4, 5, 7-9, and 14-20 having been amended by way of the present response.

In the outstanding Office Action, Claims 1-3, 8-9, 19, and 20 were rejected under 35 U.S.C. § 102(a) as being anticipated by Japanese Patent Application No. 2001-053397 to Yaguchi. Applicants respectfully assert that the rejection of the claims has been overcome for the reasons discussed below.

Applicants appreciate the Examiner's indication that Claims 4, 14, and 15, although currently objected to, would be allowable if rewritten in independent form. In response, Applicants have so-rewritten the claims. Thus, for at least these reasons, Applicants respectfully request that Claims 4, 14, and 15 be allowed.

Independent Claim 1 has been amended to recite differing features, and Claims 5, 7-9, and 16-20 have been amended so as to be consistent with the features recited in independent Claim 1 and/or to remove the recitation of duplicative features. Applicants respectfully assert that support for these changes to the claims are self-evident from the originally filed disclosure, including the original claims, and that therefore no new matter has been added.

The present invention is directed to a multi-layer wiring board. As recited in independent Claim 1, a base board includes two conductor layers, two insulating layers disposed between the two conductor layers, and at least one of a power layer and a ground layer disposed between the two insulating layers. A first hole, formed through the base board, includes an insulating portion filled with an insulator. A pair of second holes is formed within the first hole through the insulating portion. Examples of advantages include that

because the at least one of the power and ground layer is disposed on a layer that is separate from the conductive layers, a range of diameters of the first and second holes can be increased such that an impedance of the holes can be equal to an impedance of wiring patterns while maintaining electrical isolation of (i) the at least one of the power and ground layer from (ii) the conductive layers, thereby preventing a degradation of a signal.¹ Examples of other advantages are discussed throughout the specification.

According to the enclosed English language translation obtained from the Japanese Patent Office website, Yaguchi is directed to a double-sided printed wired board. As shown in Figures 1 and 2(a)-2(d), for example, of Yaguchi, a grounding conductor 25 surrounds and extends parallel to through holes for signal lines 27 and 28. Thus, at an upper surface layer 22 of the wired board, a signal line 32 (i.e., a conductor) is at a same level as the grounding conductor 25. Similarly, at a lower surface layer 23, a signal line 33 is at a same level as the grounding conductor 25.

Thus, Applicants respectfully assert that Yaguchi does not teach the claimed features of a multi-layer wiring board including a base board having two conductor layers, two insulating layers disposed between the two conductor layers, and at least one of a power layer and a ground layer disposed between the two insulating layers, and therefore also does not teach the claimed features of a first hole formed in such a base board and a pair of second holes formed within the first hole, as recited in independent Claim 1. Specifically, independent Claim 1 recites “a multi-layer wiring board comprising [] a base board including two conductor layers, two insulating layers disposed between the two conductor layers, and at least one of a power layer and a ground layer disposed between the two insulating layers.”

¹ Please see, for example, page 3, lines 4-16; page 8, lines 10-17; and page 9, lines 10-15, of the originally filed disclosure.

Thus, for at least these reasons, Applicants respectfully request that the rejection of independent Claim 1 under 35 U.S.C. § 102(a) be withdrawn and the independent claim allowed.

Dependent Claims 2, 3, 5-9, and 16-20 depend from independent Claim 1, and are therefore also allowable for at least the same reasons as the independent claim. Thus, for at least these reasons, Applicants respectfully request that dependent Claims 5-7 and 16-18, previously withdrawn from consideration, be considered on the merits, and that the rejection of dependent Claims 2, 3, 8, 9, 19, and 20 under 35 U.S.C. § 102(a) be withdrawn, and that dependent Claims 2, 3, 5-9, and 16-20 be allowed.

Consequently, in view of the present amendment, no further issues are believed to be outstanding in the present application, and the present application is believed to be in condition for formal Allowance. A Notice of Allowance for Claims 1-9, and 14-20 is earnestly solicited.

Should the Examiner deem that any further action is necessary to place this application in even better form for allowance, the Examiner is encouraged to contact the undersigned representative at the below listed telephone number.

Respectfully submitted,



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IN THE CLAIMS

The claims have been amended as follows:

1. (Amended) A multi-layer wiring board comprising:

a base board including two conductor layers, two insulating layers disposed between the two conductor layers, and at least one of a power layer and a ground layer disposed between the two insulating layers;

a first hole, formed through the base board, including an insulating portion filled with an insulator; and

a pair of second holes formed within the first hole through the insulating portion.

4. (Amended) [The] A wiring board [according to claim 1,] comprising:

a base board;

a first hole, formed through the base board, including an insulating portion filled with an insulator; and

a pair of second holes formed within the first hole through the insulating portion,

wherein a shortest length of the insulator filled between the pair of the second holes is shorter than a shortest length of the insulator filled between the first hole and one of the second holes.

5. (Amended) The wiring board according to claim 1,

[wherein the base board includes an insulating layer,]

wherein the insulating portion is filled with an insulator which has a higher dielectric constant than an insulator in the insulating [layer] layers.

7. (Amended) The wiring board according to claim 1 [further comprising insulating layers on an upper surface and a lower surface of the base board],

wherein the second holes are formed through the insulating layers,

wherein the [insulating] conductor layers include at least two pairs of wiring patterns formed on the upper surface and the lower surface of the base board,

wherein the pair of the second holes connects the two pairs of the wiring patterns,

wherein the pair of the second holes is formed by calculating a diameter of the pair of the second holes and a length between the pair of the second holes based on an impedance of the pair of the second holes and an impedance of the two pairs of the wiring patterns.

8. (Amended) The wiring board according to claim 1,

wherein the [wiring board is a multi-layer wiring board including at least two] conductor layers are coated with a conducting material.

9. (Amended) The wiring board according to claim 8,

wherein the first hole is formed at least through the two conductor layers,

wherein the pair of the second holes is formed by forming the insulating layers on an upper surface and a lower surface of the two conductor layers, forming a plurality of wiring patterns on an upper surface and a lower surface of the insulating layer, and forming holes through at least [four] five layers of the two conductor layers [and], two insulating layers, and the at least one of the power layer and ground layer.

14. (Amended) [The] A wiring board [according to claim 2,] comprising:

a base board;

a first hole, formed through the base board, including an insulating portion filled with

an insulator; and

a pair of second holes formed within the first hole through the insulating portion,
wherein each of the second holes includes a conducting portion for transmitting a
differential signal,

wherein a shortest length of the insulator filled between the pair of the second holes is shorter than a shortest length of the insulator filled between the first hole and one of the second holes.

15. (Amended) [The] A wiring board [according to claim 3] comprising:

a base board;

a first hole, formed through the base board, including an insulating portion filled with
an insulator; and

a pair of second holes formed within the first hole through the insulating portion,

wherein the pair of the second holes is located symmetrical to each other with respect
to a center axis of the first hole for forming a coaxial structure,

wherein a shortest length of the insulator filled between the pair of the second holes is shorter than a shortest length of the insulator filled between the first hole and one of the second holes.

16. (Amended) The wiring board according to claim 2,

[wherein the base board includes an insulating layer,]

wherein the insulating portion is filled with an insulator which has a higher dielectric constant than an insulator in the insulating [layer] layers.

17. (Amended) The wiring board according to claim 3,

[wherein the base board includes an insulating layer,]

wherein the insulating portion is filled with an insulator which has a higher dielectric

constant than an insulator in the insulating [layer] layers.

18. (Amended) The wiring board according to claim 4,

[wherein the base board includes an insulating layer,]

wherein the insulating portion is filled with an insulator which has a higher dielectric constant than an insulator in the insulating [layer] layers.

19. (Amended) The wiring board according to claim 3 [further comprising insulating layers on an upper surface and a lower surface of the base board],

wherein the second holes are formed through the insulating layers,

wherein the [insulating] conducting layers include at least two pairs of wiring patterns formed on the upper surface and the lower surface of the base board,

wherein the pair of the second holes connects the two pairs of the wiring patterns,

wherein the pair of the second holes is formed by calculating a diameter of the pair of the second holes and a length between the pair of the second holes based on an impedance of the pair of the second holes and an impedance of the two pairs of the wiring patterns.

20. (Amended) The wiring board according to claim 3,

wherein the [wiring board is a multi-layer wiring board including at least two] conductor layers are coated with a conducting material.